

### DELAWARE RIVER BASIN TRIBUTARY OF POHOPOCO CREEK PENNSYLVANIA

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NDI ID PA 00571

PA DER 45-258

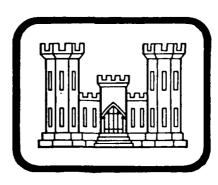
### LEVEL

### HEMLOCK LAKE DAM

OWNED BY

HEMLOCK LAKE PROPERTY OWNERS ASSOCIATION

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS

PREPARED FOR

BALTIMORE, MARYLAND 21203





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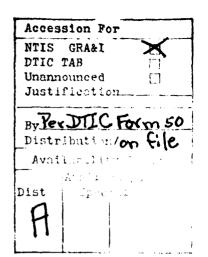


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National Dam Inspection Program. Hemlock Lake
Dam (NDI ID PA 00571, PA DER 45-258),
Delaware River Basin, Tributary of Pohopoco
Creek, Pennsylvania. Phase I
Inspection Program.

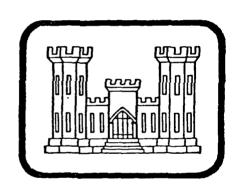
DELAWARE RIVER BASIN

HEMLOCK LAKE DAM PENNSYLVANIA

NDI ID PA 00571

OWNED BY HEMLOCK LAKE PROPERTY OWNER'S ASSOCIATION

PHASE I INSPECTION REPORT NATIONAL DAM INSPECTION PROGRAM



Prepared for:

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

Prepared by:

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Contract DACW31 - 81-C-00/6

APRIL 1881

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### PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected, and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

### PHASE I REPORT

### NATIONAL DAM SAFETY PROGRAM

Name of Dam:
State Located:
County Located:
Stream:
Coordinates:
Dates of Inspection:

Hemlock Lake Dam Pennsylvania Monroe Tributary of Pohopoco Creek Latitide 40<sup>0</sup>55.3', Longitude 75<sup>0</sup>27.7' December 19, 1980 and March 12, 1981

### **ASSESSMENT**

Hemlock Lake Dam is an earth embankment about 450 feet long and 27 feet high. An ungated overflow spillway is located at the right abutment. A paved roadway has been constructed on the dam crest and a bridge has been constructed over the spillway. The dam was constructed in the early 1950's to provide a lake for recreational purposes.

Hemlock Lake Dam has a maximum storage capacity of 117 acre-feet and a maximum height of 27 feet. The dam is classified as "Small" size. Due to the potential for excessive property damage and the loss of more than a few lives in the damage center which consists of 5 houses with door sills as low as 5 feet above the stream bed located within 1,500 feet downstream of the dam, the structure is classified as a "High" hazard.

Examination of the results of the hydrologic and hydraulic analyses indicates that the spillway is capable of passing approximately 26 percent of the Probable Maximum Flood (PMF) without the dam being overtopped. The selected Spillway Design Flood (SDF) for this "Small" size, "High" hazard potential structure is the PMF. The water surface elevation at the damage center is 2.4 feet higher for the breach condition than for the non-breach condition. The spillway is classified as "Seriously Inadequate, Unsafe, Non-Emergency" since breaching of the dam significantly increases the downstream hazard potential.

>> Based on visual observations and a review of the information obtained from the Pennsylvania Department of Environmental Resources (DER), Hemlock Lake Dam appears to be in poor condition.

### Recommendations and Remedial Measures

The following recommendations and remedial measures should be initiated immediately.

The Owner should retain the services of a licensed professional engineer experienced in the design and construction of dams to assist in complying with the following recommendations and remedial measures.

### HEMLOCK LAKE DAM NDI ID PA 00571

### Facilities

- Detailed hydrologic and hydraulic analyses should be performed to evaluate the discharge capacity of the spillway and remedial measures should be taken to increase the spillway capacity.
- All depressions in the downstream embankment face should be filled with suitable compacted material.
- An investigation should be made to assess the source and extent of the seepage observed at the downstream toe of the dam.
  - A stability analysis of the embankment should be made.
- 5. The embankment should be cleared of all trees, stumps and brush and the resulting voids should be backfilled with suitable compacted material. A grass cover should be established and maintained on the slopes of the dam.
- Assess the need for embankment protection on the upstream face of the dam.
- 7. The operability of the reservoir drain valve should be determined, and if not operable, should be made operational.
- 8. Provisions should be made for the emergency closure of the upstream end of the outlet pipe.
- The adequacy of the energy dissipator at the downstream end of the spillway chute during high discharge conditions should be evaluated.
- 10. Repair minor spalling of concrete on the approach channel walls of the spillway.

### b. Operation and Maintenance Procedures

1. A regular inspection and maintenance program should be developed and implemented.

A system for warning downstream residents in the event of an impending dam failure should be developed.

BRIEN & GERE ENGINEERS

Peter C. Johnson, P.E.

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Date: 29 Apr. / 8/

Senior Vice President

Pennsylvania, Registration No. PE-02246-E

Approved by:

Date: 21 MAy 8/

Commonel, Corps of Engineers

District Engineer

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OVERVIEW FROM THE DOWNSTREAM RIGHT ABUTMENT.

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### PHASE I REPORT NATIONAL DAM INSPECTION PROGRAM HEMLOCK LAKE DAM NDI ID PA 00571 PA DER 45-258

### SECTION 1

### PROJECT INFORMATION

### 1.1 General

- a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.
- b. <u>Purpose</u>. The purpose of this inspection is to determine if Hemlock Lake Dam constitutes a hazard to human life or property.
- 1.2 <u>Description of Project</u> (Based on information obtained from the Pennsylvania Department of Environmental Resources (DER), Division of Dam Safety, Harrisburg, Pennsylvania, and from the field inspection.)
- a. Dam and Appurtenances. Hemlock Lake Dam is an earth embankment approximately 450 feet long with a maximum height of 27 feet. An ungated concrete overflow spillway, 15 feet wide, is located at the right abutment of the embankment. The crest of the embankment is paved with asphalt and a concrete decked bridge has been constructed over the spillway.

The dam, which is located at the southern end of the impoundment, has a crest width of about 17 feet. The approximate upstream and downstream slopes of the embankment are 3H:1V and 1.5H:1V, respectively.

The spillway has a rectangular cross section with a clear vertical opening of 3.2 feet to the bottom of the bridge deck. The spillway chute is lined with concrete to the downstream toe of the embankment.

The surface area of the impoundment is 9.2 acres at normal pool. The reservoir is used for recreational purposes.

- b. Location. Hemlock Lake Dam is located on a tributary to Pohopoco Creek in Monroe County, Polk Township, Pennsylvania. The dam and impoundment are shown on USGS Quadrangle sheet titled "Brodheadsville, PA" at coordinates N 40°55.3', W 75°27.7' approximately 4 miles west of Brodheadsville, Pennsylvania. A regional location plan of Hemlock Lake Dam is included as Figure 1, Appendix E of this report.
- c. <u>Size Classification</u>. The maximum height of Hemlock Lake Dam is 27 feet and the maximum reservoir storage is 117 acre feet. The dam is therefore classified as a "Small" size dam (height less than 40 feet and storage less than 1,000 acre feet).

- d. <u>Hazard Classification</u>. Five houses which would be affected by the failure of the dam are located within 1,500 feet downstream of the dam. Door sills of the dwellings are as low as five feet above the streambed. Therefore, the dam is classified as a "High" hazard structure due to the potential for the loss of more than a few lives and excessive property damage.
- e. Ownership. The dam is owned by the Hemlock Lake Property Owner's Association. All correspondence should be directed to: Hemlock Lake Property Owners' Association, RD 2, Kunkletown, PA 18058, Attention: Mr. Emil Zullo, President.
- f. <u>Purpose of Dam</u>. The dam was constructed to provide a reservoir for recreational purposes. The reservoir is currently being used for this purpose.
- g. Design and Construction History. The dam was designed by Mr. Michael A. Policelli, P.E. No permit application, design drawing or calculations have been made available. Based on a review of available information, it appears that the dam was constructed in the early 1950's. The original owner was Mr. John Roberts and the contractor was Mr. Herbert Gower. According to the Owner's representative, the original dam was apparently constructed without a spillway. During tropical storm Diane (1955), the embankment was overtopped and partially eroded. A temporary spillway was constructed between 1955 and 1960. In 1960, the present spillway was constructed.

In 1962, additional repairs made to the dam included the placement of a clay blanket on the upstream face of the dam and the placement of a concrete cut-off wall at the upstream end of the spillway inlet channel in the vicinity of the right abutment. These repairs were made to reduce seepage through the dam.

h. Normal Operating Procedures. No written operational procedures exist for this site. No restraints to flow are located in the spillway. No known minimum daily release rates are required. The reservoir drain valve is not operated on a regular basis.

### 1.3 Pertinent Data

a.	Drainage Area (Square Miles)	0.48
b.	Discharge at Dam Site (CFS)	
	Maximum Spiliway Capacity (EL 769.7)	235.
c.	Elevations (Feet above MSL)	
	Top of Dam (Low point, design top of dam unknown) Spillway Crest Normal Pool Streambed at Dam (downstream toe) Pipe Invert (Reservoir Drain)	769.7 766.0 766.0 743.0 743.0

d.	Reservoir Length (Feet)	
	Normal Pool, Elev 766 Maximum Pool, Elev. 769.7	800 900
e.	Reservoir Storage (Acre-Feet)	
	Normal Pool, Elev. 766 Maximum Pool, Elev. 769.7	80 117
f.	Reservoir Surface (Acres)	
	Normal Pool, Elev. 766 Maximum Pool, Elev. 769.7	9.2 11.6
g.	Dam Data	
	Type Length Height Top Width Side Slopes (Upstream)	Earth Embankment 450 feet 27 feet 17 feet 3H:1V 1.5H:1V No information available Upstream Clay blanket No information available
h.	Diversion System	
	None	
i.	Spillway	
	_	

Type Broad Crested Weir
Length 15 feet
Height 3.2 feet
Control None
Energy Dissipator Concrete projection at downstream end
of chute discharge channel
Downstream Channel Concrete lined chute to natural stream,

### g. Outlet Works

The second of th

Reservoir Drain Eight-inch diameter cast iron pipe, control valve located at outlet

### **ENGINEERING DATA**

### 2.1 Design

- a. <u>Data Available</u>. No engineering data was made available for Hemlock Lake Dam. Information made available by Pennsylvania DER consisted of inventory sheets prepared by the Corps of Engineers and a brief description compiled by Pennsylvania DER.
- b. Design Features. The design features are described in Section 1.2.a and are shown on the drawings in Appendix E.

### 2.2 Construction

According to the Owner's representative, the dam was originally built during the early 1950's. No information concerning the original construction of the dam is available. Modifications to the dam were made in 1960 (spillway) and in 1962 (clay blanket on the upstream face of the dam and the placement of a cut-off wall at the upstream end of the spillway inlet channel in the vicinity of the right abutment).

### 2.3 Operational Data

No operational data is available for the dam.

### 2.4 Evaluation

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- a. Availability. All data utilized in this report was provided by the Pennsylvania DER and supplemented by conversations with the Owner's representative.
- b. Adequacy. The information made available by the Pennsylvania DER, conversations with the Owner's representative and observations made during the field investigation provided adequate data for a Phase I evaluation.
- c. Validity. There appears to be no reason to question the validity of the limited data available.

### VISUAL INSPECTION

### 3.1 Findings

a. General. At the time of the initial inspection on December 19, 1980, the water surface was approximately three feet below the spillway crest. At the subsequent inspection on March 12, 1981, the water surface was at the spillway crest. No underwater areas were inspected. The observations and comments of the field inspection team are presented in Appendix A of this report.

The appearance of the facility indicates that the dam and appurtenances receive limited maintenance.

b. Dam. (Left and right hand designations are referenced looking down-stream.)

The horizontal alignment of the upstream face of the dam, which is covered with brush and weeds, appears to be good. No areas of slope failure were noted. No embankment protection is provided for the upstream face. A non-uniformity in the profile of the upstream face is evident for the full length of the embankment. A number of trees, with trunks about 6 inches in diameter and 20 to 25 feet high, are located on the upstream face near the left abutment.

The crest of the dam, which is asphalt paved, is used as a roadway. A survey along the centerline of the crest of the dam was made by the inspection team and is reproduced in Appendix A, Sheet 11B. The maximum variation in elevation over the length of the embankment is about 2 feet.

The downstream face of the embankment is on a slope of approximately 1.5H:1V. Most of the downstream face of the dam is overgrown with brush and trees. Some attempts have been made to control vegetation on the downstream face since many tree stumps are evident. The downstream face of the dam has many bulges and depressions for the full length of the embankment.

Seepage (100 gpm) was observed at the toe of the dam from near the left abutment and to about 50 feet right of the reservoir drain outlet, a total distance of about 250 feet. Seepage did not appear to contain soil particles, but iron-oxide coloring was observed at some locations.

c. Appurtenant Structures. The rectangularly shaped concrete spillway is located at the right abutment. Most of the concrete appears to be in good condition, with some minor spalling noted on the right training wall of the approach section. No settlement was observed in the spillway.

The spillway outlet chute is concrete lined and extends to the toe of the embankment near the junction of the embankment and the right abutment. The concrete in the chute appears to be in good condition. During the inspection made

on March 12, 1981, seepage (1 gpm) was observed discharging from a joint on the right side of the spillway discharge chute about 30 feet downstream of the control section of the spillway. No settlement of the individual concrete sections of the chute were noted.

No accumulation of debris was noted in the spillway or in the outlet chute. A small concrete projection is located in the invert at the downstream end of the chute which functions as an energy dissipator. The concrete decked steel bridge over the spillway appears to be in good condition.

The intake for the reservoir drain is submerged. The outlet valve is located at the downstream end of the pipe enclosed by a steel box. The valve box could not be opened for the inspection; therefore, the operability of the valve could not be determined.

- d. Reservoir. The slopes adjacent to the impoundment are moderate and covered with vegetation. No evidence of slope instability was observed.
- e. <u>Downstream Channel</u>. The reservoir drain and spillway outlet chute discharge into the natural channel downstream of the dam. The channel is about 10 feet wide with approximately 2H:1V side slopes which are about 3 feet high and the average channel slope is about 1.3 percent. Five houses, with door sills as low as five feet above the stream bed, are located within the first 1,500 feet downstream of the dam.

### 3.2 Evaluation

Based on visual observations, the dam and appurtenances appear to be in poor condition. Recommendations and remedial measures are presented in Section 7.2 of this report.

### **OPERATIONAL PROCEDURES**

### 4.1 Procedures

According to the Owner's representative, no written operational procedures exist for the dam. The impoundment is normally maintained at the normal pool for recreational purposes.

### 4.2 Maintenance of the Dam

According to the Owner's representative, no written maintenance procedures for the dam exist. The Board of Directors of the Hemlock Lake Owners' Association make an annual inspection of the dam.

Based on the visual inspection, it appears that an effort has been made to remove trees from the downstream face of the dam. The spillway and spillway outlet chute were clear at the time of inspection.

### 4.3 Maintenance of Operating Facilities

According to the Owner's representative, no written maintenance procedures for the operating facilities exist. The control valve for the reservoir drain was last operated three years ago. The Owner's representative believes that the control valve is operational.

Screens are located at the drain intake, according to the Owner's representative; however, the reservoir must be drained to clean the screens.

### 4.4 Description of Any Warning System in Effect

According to the Owner's representative, no formal warning system or procedures are established for monitoring the structure during periods of heavy rainfall or in the event of impending dam failure; however, a local resident inspects the dam periodically during intense rainfall and would personally notify the residents living downstream of the dam in the event of an impending failure.

### 4.5 Evaluation

Periodic inspection of the dam and appurtenances should be made by a qualified engineer. All controls should be operated for this inspection.

A formal maintenance program for the dam and appurtenances should be developed and implemented. Records of maintenance performed should be recorded by the Owner. A formal warning system relative to the houses downstream of the dam must be developed.

The valve located on the downstream end of the reservoir drain pipe is considered inadequate since discharge through the pipe could not be stopped in the event of a leak in the pipe. Provisions should be made for control of the reservoir drain pipe discharge upstream of the embankment.

### HYDROLOGY AND HYDRAULICS

### 5.1 Evaluation of Features

- a. Design Data The computed drainage area for Hemlock Lake Dam is about 0.48 square miles. The basin has a maximum length of about one mile and 3 maximum width of about 0.6 miles. The ground surface elevations vary from about 1,080 in the upper reaches of the drainage area to 766 at normal pool. The drainage area is essentially undeveloped forest and pasture land with residential development limited almost entirely to the immediate area of Hemlock Lake.
- b. Experience Data. Rainfall and spillway discharge records are not maintained by the Owner. According to the Owner's representative, the embankment was overtopped during tropical storm Diane (1955). The dam did not have a spillway at that time.
- c. <u>Visual Observation</u>. The spillway would appear to function adequately up to its capacity for discharge through the bridge opening. It is doubtful that the energy dissipator located at the downstream end of the spillway outlet chute would prevent erosion downstream of the chute. This could lead to erosion in the vicinity of the outlet of the spillway chute during periods of high discharge.
- d. Overtopping Potential. The overtopping potential of the dam was estimated using the HEC-1, Dam Safety Version, computer program. A brief description of the program is included in Appendix D.

Hemlock Lake Dam is classified as a "Small" size, "High" hazard dam. Accordingly, the Spillway Design Flood (SDF) ranges from fifty percent of the Probable Maximum Flood (PMF) to the full PMF. Because of proximity of the five houses located within the first 1,500 feet downstream of the dam and the potential for the loss of more than a few lives, the PMF was selected as the appropriate SDF. The PMF was routed through the reservoir with the starting water surface elevation at the spillway crest, Elev. 766.0. The peak inflow and outflow during the PMF are both about 1,180 cfs. The embankment would be overtopped by 1.3 feet for about 8.5 hours during this event. The spillway is capable of discharging about 26 percent of the PMF before overtopping of the embankment occurs.

e. <u>Spillway Adequacy</u>. In order to assess the potential for increased damage due to dam failure, the embankment was assumed to breach with water flowing 0.50 feet over the low point of the top of the dam for a period of 2 hours. A review of the results of this analysis indicates that the water surface elevation at the damage center is 2.5 feet higher for the breach condition than for the non-breach condition. Water would be in the houses within the first 1,500 feet downstream of dam to a depth of 0.8 feet for the breach condition. The spillway is classified as as "Seriously Inadequate, Unsafe, Non-Emergency" since the breaching of the dam significantly increases the downstream hazard potential.

### STRUCTURAL STABILITY

### 6.1 Evaluation of Structural Stability

a. <u>Visual Obserations</u>. The overall structural appearance of the dam at the time of the inspections was poor. The source of the seepage (100 gpm) apparent for about 250 feet along the downstream toe of the dam should be investigated to evaluate the effect of the seepage on the stability of the embankment. The bulges and depressions in the downstream face of the dam may be the result of poor construction control. No cracking in the embankment was noted. The non-uniformity of the upstream face is due to the placement of the clay blanket after the initial construction of the dam.

Because of the steep 1:5H:1V downstream slope of the embankment and the saturated condition of the foundation, the stability of the embankment is questionable, even through presently no indications of movement or slope failure are apparent.

- b. Design and Construction Data. Design and construction data is unavailable for this dam.
- c. Operating Records. According to the Owner's representative, operating records are not maintained for this dam.
- d. Post Construction Changes. A spillway was constructed in 1960. In 1962, a clay blanket was placed on the upstream face of the embankment and a concrete cut-off wall was built at the upstream end of the spillway inlet channel. Both of these measures were taken to reduce seepage through the embankment.
- e. <u>Seismic Stability</u>. Hemlock Lake Dam is located in Seismic Zone 1 as shown on the Seismic Zone Map of Contiguous States. A dam located in Seismic Zone 1 is considered to be safe under any expected Zone 1 earthquake loading conditions if it is stable under static loading conditions. Since the dam does not appear to be structurally stable for potential static loadings, it is doubtful that it would be stable for seismic loadings.

### ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

### 7.1 Dam Assessment

a. Evaluation. Based on visual observations made during the field inspections, the dam and appurtenances appear to be in poor condition. A thorough visual inspection of the embankment, however, was prohibited by the thick overgrowth.

The source of the seepage (100 gpm) observed along the toe of the dam could not be determined during the inspection. According to the Owner's representative, a clay blanket was placed on the upstream face of the dam in 1962 to reduce seepage.

The bulges observed on the downstream face appear to be the result of poor construction control. Trees were observed on the upstream face of the embankment near the left abutment. No cracks or evidence of recent movement were noted in the embankment.

The selected SDF for Hemlock Lake Dam is the PMF. Based on a review of the hydrologic/hydraulic analyses, the spillway is capable of passing about 26 percent of the PMF before the embankment would be overtopped. The spillway is classified as "Seriously Inadequate, Unsafe, Non-Emergency" since breaching of the dam seriously increases the downstream hazard potential.

Because of the location of the spillway near the right abutment and restrictions caused by the bridge over the spillway, it appears that the spillway opening could become blocked with debris. During heavy rainfall, blockages in the spillway would seriously reduce the spillway capacity.

- b. Adequacy. The information made available by Pennsylvania DER, conversations with the Owner's representative and observations made during the field investigation provided adequate data for a Phase I evaluation.
- c. Urgency. The remedial measures recommended in Section 7.2 should be implemented immediately.
- d. Necessity for Further Investigations. Further investigation should be implemented as discussed in Section 7.2.

### 7.2 Recommendations and Remedial Measures

The following recommendations and remedial measures should be initiated immediately.

The Owner should retain the services of a licensed professional engineer experienced in the design and construction of dams to assist in complying with these recommendations and remedial measures.

### a. Facilities

- 1. Detailed hydrologic and hydraulic analyses should be performed to evaluate the discharge capacity of the spillway and remedial measures should be taken to increase the spillway capacity.
- 2. All depressions in the downstream embankment face should be filled with suitable compacted material.
- 3. An investigation should be made to assess the source and extent of the seepage observed at the downstream toe of the dam.
  - 4. A stability analysis of the embankment should be made.
- 5. The embankment should be cleared of all trees, stumps and brush and the resulting voids should be backfilled with suitable compacted material. A grass cover should be established and maintained on the slopes of the dam.
- 6. Assess the need for embankment protection on the upstream face of the dam.
- 7. The operability of the reservoir drain valve should be determined, and if not operable, should be made operational.
- 8. Provisions should be made for the emergency closure of the upstream end of the outlet pipe.
- 9. The adequacy of the energy dissipator at the downstream end of the spillway chute during high discharge conditions should be evaluated.
- 10. Repair minor spalling of concrete on the approach channel walls of the spillway.

### b. Operation and Maintenance Procedures

- 1. A regular inspection and maintenance program should be developed and implemented.
- 2. A system for warning downstream residents in the event of an impending dam failure should be developed.

APPENDIX A

INSPECTION CHECKLIST

CHECK LIST VISUAL IMSPECTION PHASE I

Sheet 1 of 11

State Pennsylvania ID # PA 00571	b	re 20 <mark>0 (12/19/80)</mark>	Tailwater at Time of Inspection $\frac{\pm 743}{(12/19/80)}$
County Monore State	Hazard Category High	Weather Partly Cloudy(12/19/80)Temperature 200 (12/19/80)	Inspection $\pm 763$ M.S.L. Tailwater at Tin (12/19/80)
Name Dam Hemlock Lake Dam	Type of Dam Rolled Earth	Date(s) Inspection 12/19/80 3/12/81	Pool Elevation at Time of Inspe

L. Beck

Inspection Personnel:

Recorder L. DeHeer (3/12/81) R.E. Horvath R. Beck J. Rauschkolb R.E. Horvath

Remarks:

Both 12/19/80 & 3/12/81 The inspection team was accompained by Mr. George Harris representing The Hemlock Lake Property Owners' Association

# DRY STONE MASONRY WALL (DOWNSTREAM FACE OF DAM)

VISUAL EXAMINATION OF	OBSERVAT 1014S	REMARKS OR RECOMMENDATIONS
AHY NOTICEABLE SEEPAGE	Seepage was noted at the toe of the wall. The limits of seepage extend from about the midpoint of the spillway to the left abutment toe, a distance of about 90 feet. Seepage was also noted at an elevation 3 to 4 feet below the spillway crest for most of the length of the spillway.	The quantity of seepage is appreciable (50gpm); however, the water is clear.
STRUCTURE TO ABUTHENT/ENBAHKHENT JUNCTIONS	The abutment/embankment junctions appear to be satisfactory with no seepage noted.	
DRAINS	The dry stone masonry wall is free draining.	
WATER PASSAGES	Seepage was noted along perimeter of the reservoir drain pipe and as discussed under "any noticeable seepage".	The seepage around the reservoir drain pipe is an additional 20gpm. See remark under "any noticeable seepage".
FOULIDATION	Not observed.	

DRY STONE MASONRY WALL (DOWNSTREAM FACE OF DAM)

VISUAL EXAMINATION OF	OBSERVATIONS	Sheet 3 of 11 REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	The masonry wall was constructed as a dry rubble wall.	
STRUCTURAL CRACKING	Cracks were noted in cemented masonry training walls on either side of the spillway. The cracks extend from the crest to the water line on slopes approximating 30° from vertical in the downstream direction.	Repair the cracks in the cemented masonry training walls.
VERTICAL AND HORIZONTAL ALIGNMENT	Horizontal and vertical alignments appear to be satisfactory. A portion of the concrete cap on the spillway crest about 8 feet long is missing.	Replace the portion of missing concrete cap.
MOROLITH JOINTS	N/A	
CONSTRUCTION JOINTS	Some of the stones in the wall have been displaced. The most prominent location is about the midpoint of the spillway just above the toe. The limits of displaced stone is about 4 feet by 4 feet in area and 2 feet deep.	Replace the missing stones.

### EIBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	Sheet 4 of 11 REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	Several bulges were noted in the downstream face.	The condition appears to have occurred during or soon after construction was completed. No embankment cracking was noted.
SLOUGHING OR EROSION OF EMBANKHENT AND ABUTHENT SLOPES	A break in the profile of the upstream face was noted. The break extends for the full length of the embankment at about El. 762.	The break in slope profile is apparently due to the placement of a clay blanket on the upstream face after construction was completed.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	The horizontal alignment of the crest appears to be good. A review of the results of the field survey revealed that the maximum variation in vertical alignment is about 2 feet. No information relative to the design top of dam is available.	
RIPRAP FAILURES	Riprap has not been placed on the slopes.	Consideration should be given for placing riprap on the upstream face of the dam to protect against wave action.

# EMBANKMENT

TOOK EVENTUALION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
DRAINS	The dam does not have an internal drainage system.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No detrimental conditions were noted at the time of inspection.	
ANY NOTICEABLE SEEPAGE	Seepage (100 gpm) was noted at the toe of the dam extending for a distance of about 250 feet from near the left abutment to about 50 feet to the right of the reservoir drain outlet.	The source of the seepage could not be identified at the time of inspection. The condition should be further investigated and appropriate action taken.
STAFF GAGE AND RECORDER	None.	

		Sheet 6 of 11
VISUAL EXAMINATION OF	OBSEAVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	The conduit is constructed through the base of the embankment; there- fore, it could not be inspected.	
INTAKE STRUCTURE	Submerged and could not be inspected.	
OUTLET STRUCTURE	The reservoir drain outletis enclosed in a steel plate box. The control valve which is located inside the steel plate structure was inaccessible during the inspection.	l
OUTLET CHANNEL	The natural stream channel is the outlet channel.	
EMERGENCY GATE	The valve is located in the outlet structure.	The valve should be inspected and maintained on a regular basis. Provision should be made for emergency closure of the outlet pipe upstream of the embankment.

# UNGATED SPILLWAY

		Sheet 7 of 11
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	The concrete at the control section appears to be in good condition. No cracking or spalling of concrete surfaces were noted.	
APPROACH CHANNEL	The invert of the approach channel appears to be in good condition. No settlement was noted in the concrete sections. Some minor spalling of the concrete surfaces was noted in the sidewalls of the channel. No reinforcing steel is exposed at these locations.	Repair the minor spalling.
DISCHARGE CHAIMEL	The concrete in the discharge channel appears to be in good condition. No settlement was noted in the concrete section. Seepage (1 gpm) was noted coming from the right sidewall of the spillway outlet chute about 30 feet downstream from the top of the dam.	The seepage should be periodically monitored to detect any increase in quantity of seepaye or discoloration in the flow.
BRIDGE AND PIERS	The bridge constructed over the spillway appears to be in good condition.	
ENERGY DISSIPATOR	The energy dissipator appears to be undersized for the anticipated discharge.	

# GATED SPILLWAY

		Sheet 8 of 11
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
COMCRETE SILL	N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BAIDGE AND PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	

# INSTRUMENTAT ION

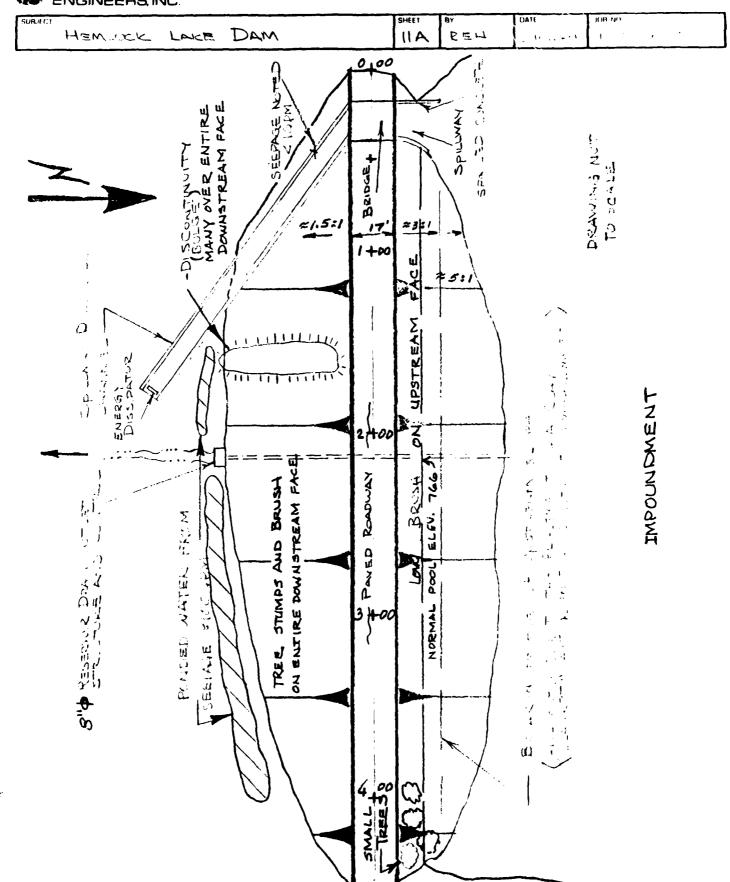
VISUAL EXAMINATION	OBSERVAT1011S	Sheet 9 of 11 REMARKS OR DECOMMENDATIONS
MONUMENTATION/SURVEYS		A MECONINCIONAL LONS
	None.	
OBSERVATION WELLS	None.	
WEIRS	None,	
PIF70MFTFRS	None.	
ОТНЕЯ	None.	

# RESERVOIR

		Sheet 10 of 11
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECONMENDATIONS
SLOPES	The slopes to the reservoir are steep. No evidence of earth slides into the reservoir are apparent.	
SEDIMENTATION	No measurement of sedimentation was made. However, based on conversations with local residents and visual observations, the impoundment appears to be heavily silted.	

# DOWNSTREAM CHANNEL

		Sheet 11 of 11
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
COMDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Small foot bridges and small channel stabilization structures are the extent of channel obstructions for approximately one half mile downstream of the dam.	
SLOPES	The overbanks of the downstream channel are relatively flat. The channel banks average about 2H:1V. The invert of the channel has an average gradient of about 1.3 percent.	
APPROXIMATE NO. OF HOMES AND POPULATION	5 homes are located within 1,500 feet downstream of the dam. The lowest door sill of the dwellings is about 5 feet above the stream bed. Between 20 and 30 people are associated with these houses.	



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APPENDIX B

CHECKLIST ENGINEERING DATA

DESTGA, CUMSTRUCTION, OPERATION PHASE I

HAME OF DAM Hemlock Lake Dam

0057 (

# 01

Sheet 1 of 4

AS-BUILT DRAWINGS

ITEM

No "as built" drawings are available.

REMARKS

REGIONAL VICINITY MAP

Refer to Appendix E, Figure 1.

CONSTRUCTION HISTORY

Refer to Section 1.2.g

TYPICAL SECTIONS OF DAM

Refer to Appendix E.

OUTLETS - PLAIS

None availalbe. None availalbe. None available.

CONSTRAINTS

DETAILS

None available.

DISCHARGE RATINGS

Rainfall/reservoir records are not maintained by the Owner.

RAINFALL/RESERVOIR RECORDS

ITEN	REMARKS Sheet 2 of 4	4
DESIGN REPORTS	None Available.	
GEOLOGY REPORTS	None available.	
DESIGM COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available.	
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available.	
POST-CONSTRUCTION SURVEYS OF DAM	None available.	
BORROW SOURCES	No information available.	

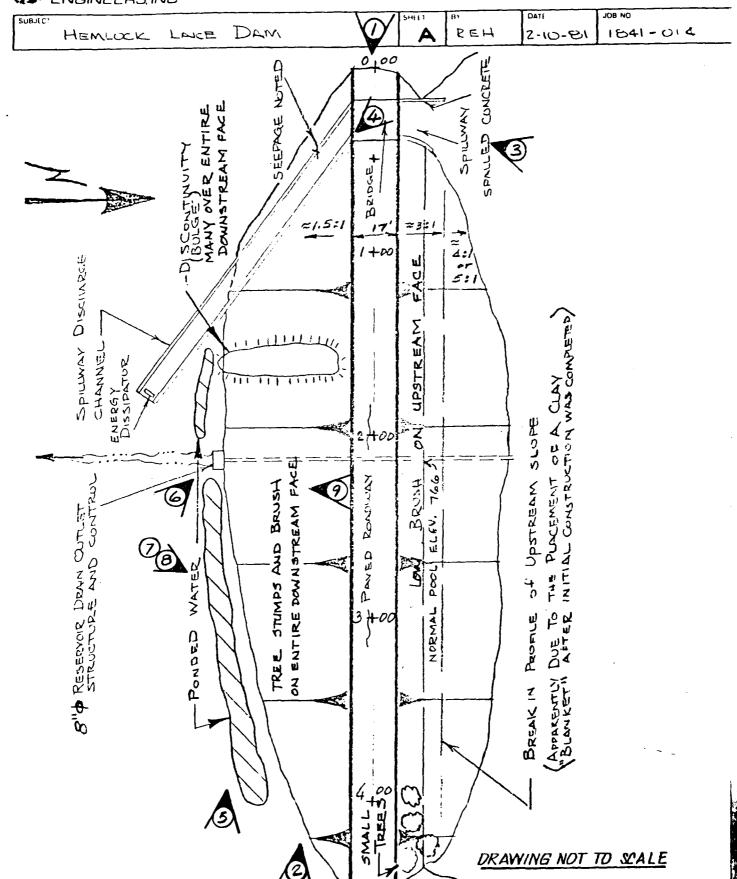
	Sheet 3 of 4
ITEM	REMARKS
HUNITURING SYSTEMS	None.
MODIFICATIONS	1. Spillway constructed in 1960. 2. Clay blanket placed on upstream slope in 1962. 3. Concrete cutoff constructed at spillway in 1962
HIGH POOL RECORDS	Records are not maintained by Owner.
POST COMSTRUCTION ENGINEERING STUDIES AND REPORTS	None available.
PRIOR ACCIDENTS OR FAILURE OF UAM DESCRIPTION REPORTS	AAM According to the Owner's representative, the embankment was overtopped during tropical storm Diane (1955). No spill-way was constructed at this time.
IM INTENANCE OPERATION	No maintenance records are maintained.

	Sheet	Sheet 4 of 4
H311	REMARKS	
SPILLWAY PLAN   SECTIONS   DETAILS	None available.	
OPERATING EQUIPMENT PLANS & DETAILS	None available.	
MISCELLANEOUS		

APPENDIX C PHOTOGRAPHS

# APPENDIX C PHOTOGRAPH TABLE OF CONTENTS

		Page No
Site	Plan	Α
рнот	<u>OGRAPH</u>	
No.		
1.	View along the top of the dam from the right abutment. (12/20/80)	1
2.	View along the top of the dam from the left abutment. (12/20/80)	1
3.	Looking downstream at the spillway entrance channel. (12/20/80)	2
4.	Looking downstream at the spillway exit channel. (12/20/80)	2
5.	Typical view of the downstream face of the dam. (12/20/80)	3
6. 7. 8.	Reservoir drain outlet. (12/20/80) Seepage at the downstream toe of the dam. (12/20/80) Close-up of the seepage at the downstream toe of the	3 4 4
9.	dam. (12/20/80)  Downstream channel as seen from the top of the dam. (12/20/80)	5
10.	Potential damage area about 500 feet downstream of the dam. (12/20/80)	5

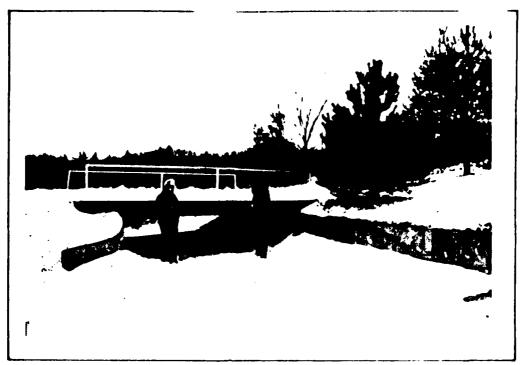




 VIEW ALONG THE TOP OF THE DAM FROM THE RIGHT ADUTMENT. (12/20/80)



2. VIEW ALONG THE TOP OF THE DAM FROM THE LEFT ABUTMENT. (12/20/80)



3. LOOKING DOWNSTREAM AT THE SPILLWAY ENTRANCE CHANNEL. (12/20/80)



4. LOOKING DOWNSTREAM AT THE SPILLWAY EXIT CHANNEL.



5. TYPICAL VIEW OF THE DOWNSTREAM FACE OF THE DAM. (12/20/80)



6. RESERVOIR DRAIN OUTLET. (12/20/80)



7. SEEPAGE AT THE DOWNSTREAM TOE OF THE DAM. (12/20/80)



8. CLOSE-UP OF THE SEEPAGE AT THE DOWNSTREAM TOE OF THE DAM. (12/20/80)



9. DOWNSTREAM CHANNEL AS SEEN FROM THE TOP OF THE DAM. (12/20/80)



10. POTENTIAL DAMAGE AREA ABOUT 500 FEET DOWNSTREAM OF THE DAM. (12/20/80)

APPENDIX D

HYDROLOGIC AND HYDRAULIC ENGINEERING DATA

#### HEMLOCK LAKE DAM HYDROLOGIC & HYDRAULIC ENGINEERING DATA

### TABLE OF CONTENTS

	Sheet No.
Check List Hydrologic & Hydraulic Engineering Data.	1
HEC-1, Revised Flood Hydrograph Package.	2
Hydrology Computations.	3
Hydrology & Hydraulics Computations.	4
HEC-1, Dam Safety Version, Computer Printout. HEC-1, Dam Safety Version, With Breach, Computer	7 through 10
Printout.	11 through 16

## CHECK LIST HYDROLOGIC AND HYDRAULIC ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Rural, wooded, pasture land, some residential development especially in vicinity of dam, and lake
ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 766 MSK & A. F.+)
ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY):
ELEVATION MAXIMUM DESIGN POOL:
ELEVATION TOP DAM, LOW PT. (STORAGE CAPACITY): 769.7MS.(117 Ac. Ft.)
SPILLWAY
a. Elevation 766 MSL
b. Type Concrete Channel Section
c. Width ====================================
d. Length = 18 fee + (level section) outlet concrete
e. Location Spillover Right Abstment 200 Ft. long
f. Number and Type of Gates None
OUTLET WORKS:
a. Type 8-inch diameter cost iron pipe
b. Location A+ low point of volley
c. Entrance inverts $\simeq$ 744 MSL
d. Exit inverts = 743 MSL
e. Emergency draindown facilities Sinch diameter control value
HYDROMETEOROLOGICAL GAGES:
a. Type None in watershed
b. Location N/L
c. Records N/A
MAXIMUM NON-DAMAGING DISCHARGE: Not Known
* Elevations estimated from USGS good.

#### HEC-1, REVISED FLOOD HYDROGRAPH PACKAGE

The original "Flood Hydrograph Package" (HEC-1), developed by the Hydrologic Engineering Center, Corps of Engineers, has been modified for use under the National Dam Inspection Program. The "Flood Hydrograph Package (HEC-1), Dam Safety Version", hereinafter referred to as, HEC-1, Rev., has been modified to require less detailed input and to include a dam breach analysis. The required input is obtained from the field inspection of a dam, any available design/evaluation data, relatively simple hydraulic calculations, or information from the USGS Quandrangle maps. The input format is flexible in order to reflect any unique characteristics of an individual dam.

HEC-1, Rev. computes a reservoir inflow hydrograph based on individual watershed characteristics such as: area, percentage of impervious surface area, watershed shape, and hydrograph characteristics determined from regional correlation studies by the Corps of Engineers, Baltimore District. The inflow is routed through the reservoir using spillway discharge data obtained from the field inspection or design data. Flood storage capacity is determined from USGS maps or design information and verified by the field inspection. In the event a spillway cannot discharge 0.5 PMF without overtopping and failure of the dam, downstream channel characteristics obtained from the field inspection and USGS maps are inputed and flows are routed downstream to the damage center and a dam breach analysis is performed.

Included in this Appendix are the HEC-1, Rev. pertinent input values and a summary print-out.

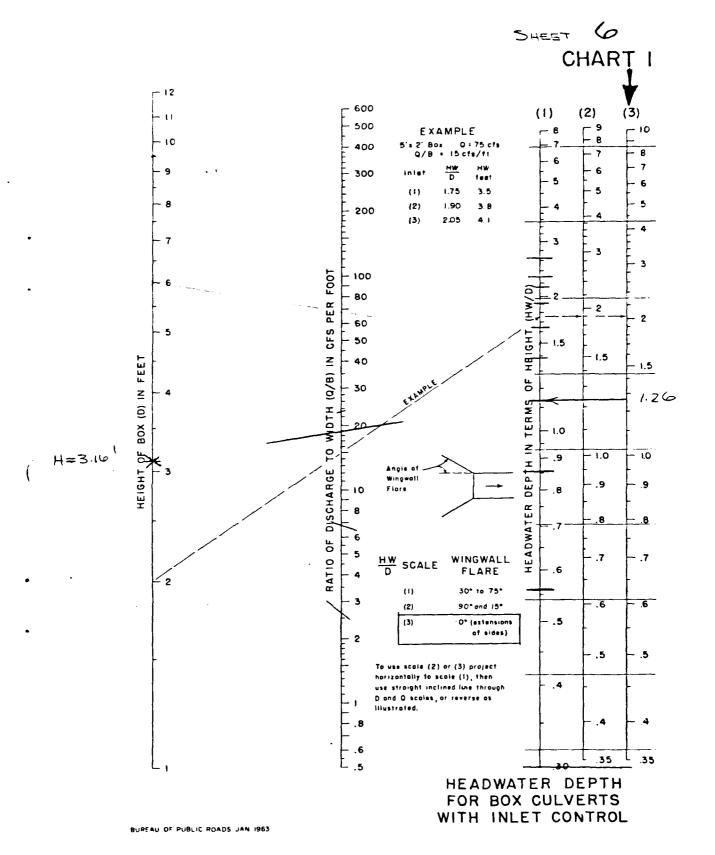
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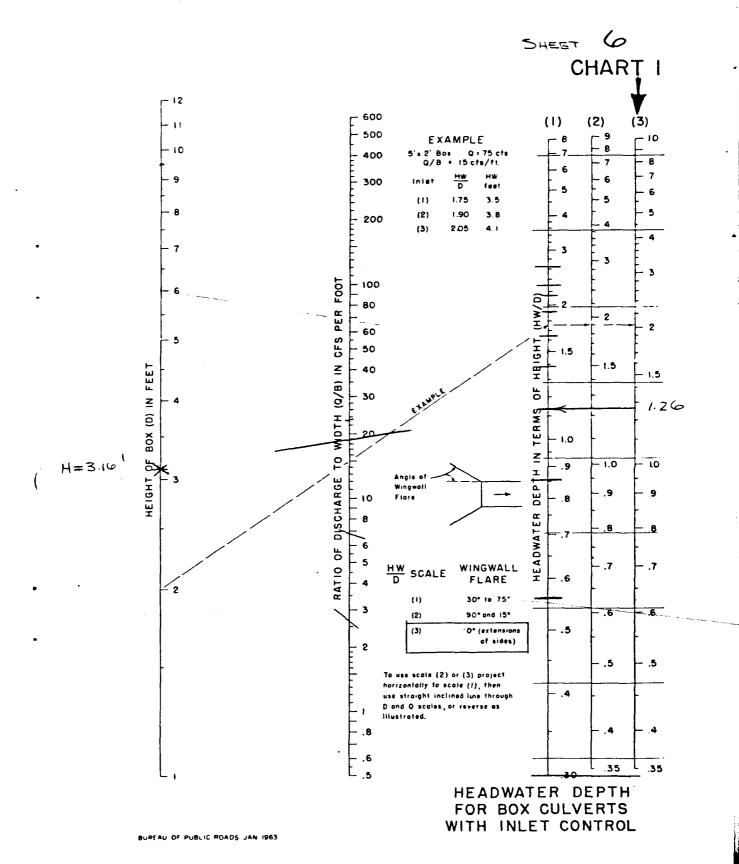
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							5T <i>f</i>	#	SURFA	, J	#				CF.	급		BEGIN D	FEAK OUTFLOW		PEAK OUTFLOW

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HYDROGRAF 4 SOUTING

ROUTING DOWNSTREAM TO DAMAGE CENTER

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	PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIFLE FLAN-RATIO ECONOMIC COMPUTATIONS FLOWS IN CURIC FEET FEET PER SECOND (CUBIC METERS PER SECOND)	TATES CONCHILE NILUME TENS	KA1108 APPLIE						
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	AND STORAC		AREA		1.24)	1.24)		1.24)	
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	-		OPERATION	HYDROGRAFH AT INFLOW		ROUTED TO		-ROUTER TO	
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		TIME OF FAILURE HOURS .		FAILURE HOURS	00.0					
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LYSIS		DUKATION OVER-10P HOURS		FURATION DVER TOP HOURS	n.00	į		1.50	TIME HOURS	
SUMMARY OF DAM SAFETY ANALYSIS	SFILLWAY CREST	HAXIMUH BUTFEOW CFS	9P1LLWAY CREST 766.00 80.	HAXINUM DUTFLOW CFS	585.	STATION PREACH	STA		MAXIMUM STAGE,FT	
HARY OF DA	IAL VALUE 766700 80, 0.	MAXIHUM STOKAGE AC-FT	.00 80.	HAXIMUH STORAGE AC-FT	127.	FLAN 1	FLOW, CFS	PLAN 2	MAXIMUM ——FEOW+GFS	
SU	INITIAL VALUE 766:00 90.	HAXIMUM PEPTH OVER DAM		HAXIMUN DEFTH OVER DAM	88	4	RATIO	7d	KATIB	
	ELEWATION STORAGE OUTFLOW	MAXINUM RESERVOIR W.S.ELEV	ELEVATION STORAGE CUTFLOW	MAXIMUM RESERVOIR W.S.ELEV	770.55					
	1	RATIO OF PMF		FMF			·			
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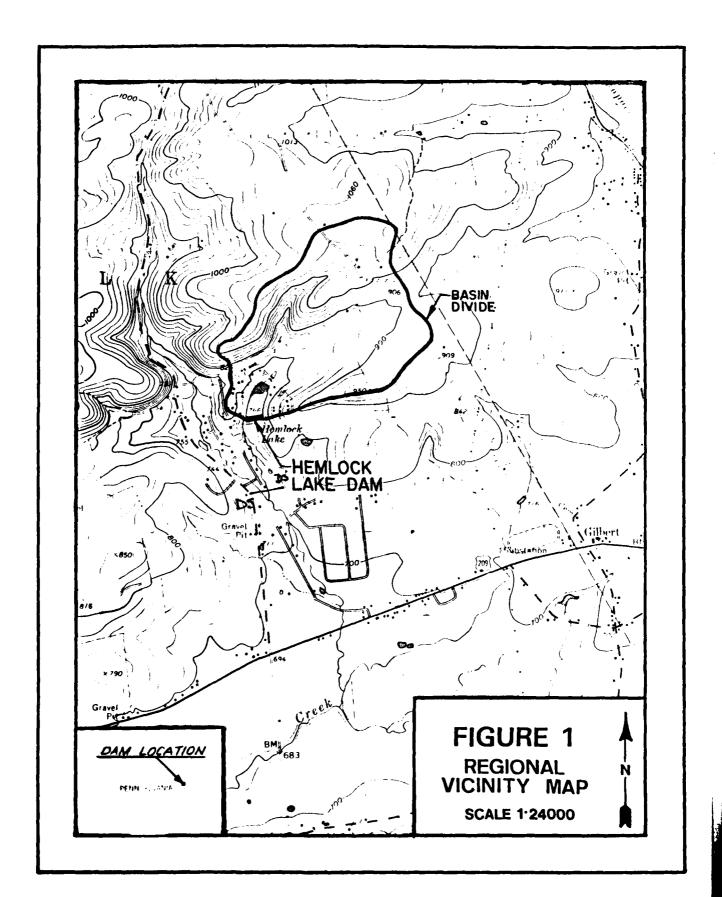
APPENDIX E

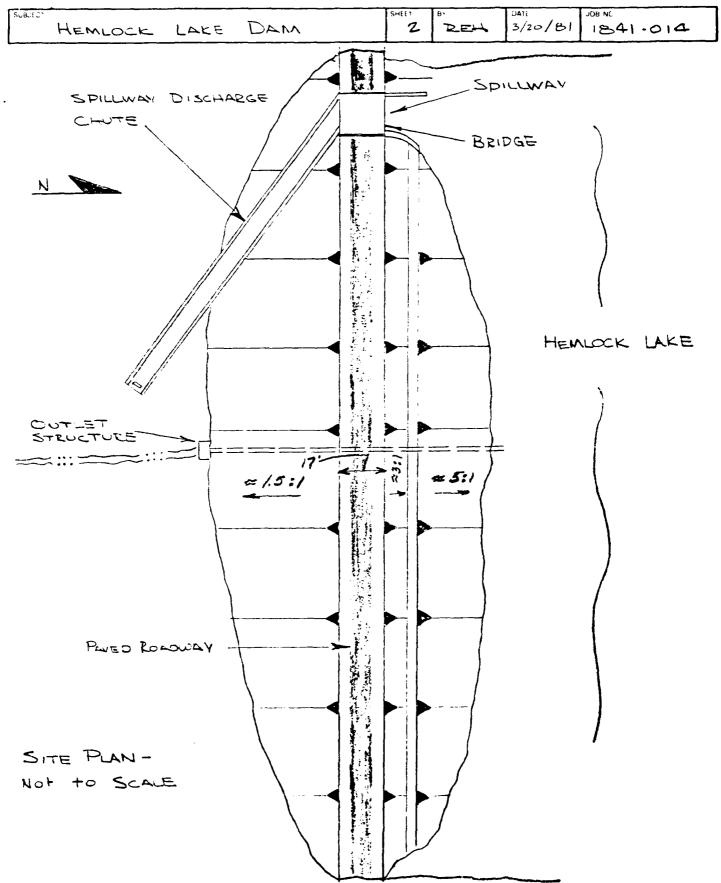
REGIONAL VICINITY MAP

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DRAWINGS

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SUBJECT JOB NO 1841 . 014 5HEET Dan 3/20/81 HENLOCK REH LAKE Normal pixol E1 766 Break in profile of upstream placement of a clay blanket slope (apparently due to the ASSUMED EMBANEMENT SECTION # F . Paved roaduay El 76967 - Low point top of dam E1. 743 - Toc of dam

APPENDIX F

# SITE GEOLOGY HEMLOCK LAKE DAM

Hemlock Lake Dam is located in the Southern New York Section of the Appalachian Plateau Physiographic Province. As shown in Figure 1, bedrock at the damsite is composed of a shale/sandstone combination known as the Hamilton Group of the Middle Devonian period. The shales are brown to olive in color. The interbedded sandstones are dominant in places, highly fossiliferous in the upper stratas and contain "centerfield coral beds" especially in the region of the site. No known active faults or structural defects are known to be located in the vicinity of the dam and lake.

